ACUSON

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MODULE 1

INTRODUCING SEQUOIA® ULTRASOUND TECHNOLOGY

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REVISION HISTORY

QRC	P/N-REVISION	INITIATOR	APPROVAL	DATE	CHANGE
			S. Williams	July 1999	Incorporate reviewer comments
A3210	49880 Rev. 1	J. Madarasz	S. Williams	Dec. 2000	Initial Release

SEQUOIA ULTRASOUND TECHNOLOGY

The Sequoia system is the most fundamental and far-reaching advance in ultrasound imaging technology since the advent of Computed Sonography in 1983. It incorporates four foundation technologies that produce dramatic image quality, performance, and functionality improvements in all modes of operation. These foundation technologies include:

- Sequoia proprietary Coherent Image Formation technology
- Doppler Technology
- DIMAQ™ Integrated Ultrasound Workstation
- Transducer Technology

USER INTERFACE AND INDUSTRIAL DESIGN

A great deal of foresight and research resulted in the industrial design of the Sequoia ultrasound system. The Sequoia system's design is based on human factors analysis which involved extensive research in a combination of ergonomics and user interface design.

The tilt-and-swivel display, height-adjustable keyboard and display, portability, micro-positioning, quieter system operation, simplified maintenance, tactile controls, and operator-focused speaker system are just a few examples of an industrial design that offers fatigue-free operation and timeless style.

HIGH DENSITY ELECTRONIC PACKAGING

Partnerships with two other leading electronics companies have produced some of the highest density ASICs (Application Specific Integrated Circuits) and 16-layer printed circuit boards.

DISPLAY TECHNOLOGY

A partnership with a major European manufacturer has resulted in the availability of display monitors of high-information density.

COHERENT IMAGEFORMER

The **Multiple Beamformer** is a new beamformer architecture that utilizes 512 (Sequoia 512) or 256 (Sequoia C256) digital processing channels, the equivalent of four channels per transducer array element in a 128 element transducer. This unique architecture produces the following results:

- Beam contains phase and amplitude; not done in conventional beamformer-based systems.
- Beams are acquired simultaneously to capture motion between beams
- Multiple Beams are acquired in the same amount of time that a single beamformer acquires a single beam.

The high-speed data acquisition generated by multiple beamformers translates directly into significantly higher frame rates, higher spatial resolution, and increased sensitivity in 2-D and Color Doppler imaging Modes.

COHERENT IMAGEFORMER

Phase information is used by the **Coherent Imageformer** to generate additional information that cannot be obtained without using phase.

Physicists have known for years that half of the signal information is contained in phase component and the other half is in amplitude component, but a practical method to use phase information eluded them. Now this long-standing problem has been solved, paving the way for the advent of an imageformer-based system.

The Coherent Imageformer acquires images with twice the information in half the time, a quantum advance in ultrasound state of the art. This manifests itself as extremely wide dynamic range, greater spatial resolution, higher frame rates and better differentiation. Images contain higher tissue integrity and greater uniformity.

IMAGE CELLS

The Sequoia system Coherent Imageformer uses multiple beams with encoded phase and amplitude data to construct **image cells**. Image cells are two- dimensional; that is, they contain range and azimuth, as opposed to one- dimensional scan lines. Use of phase data provides accurate amplitude information between beams without resorting to conventional interpolation (a smoothing which may be inaccurate). Since data between beams is known, the image is acquired in a continuous way, and not along scan lines.

DIMAQ™ INTEGRATED ULTRASOUND WORKSTATION

The integration of a special purpose workstation into the system architecture is at the heart of the Sequoia system's digital image management.

Integration means that the DIMAQ workstations has direct access to data in every part of the system. This is not possible on an external workstation, regardless of any computational power. Access to this data means that the DIMAQ workstation can perform image analysis functions which will become available in future. Thus, the DIMAQ workstation becomes the key to sustained technological and application advances.

Numerous powerful system capabilities have been designed into the DIMAQ workstation which allow it to:

- Expand the science of quantification
- Expand AEGIS® Digital image and data management capabilities
- Perform JPEG compression
- Display multiple static and dynamic images
- Direct Ethernet and DICOM connectivity
- Perform special applications, such as Stress Echo.

DOPPLER TECHNOLOGIES

SOLO™ DOPPLER BEAMFORMER

Ultrasound engineers have always known that the characteristics of Doppler signals are vastly different from the tissue signal characteristics. In beamformer-based systems, the same beamformer is used for both signals. This forces a trade-off between image quality and spectral quality. Sequoia system technology solves this trade-off by creating a unique architecture, with multiple beamformers dedicated to 2-D, and a dedicated audio beamformer for the spectral Doppler. Doppler information is processed at audio frequencies.

The result is a new level of performance. Sequoia system offers a major sensitivity improvement in all Doppler modes: PW, CW, HPRF, and AUX CW.

CD PERFORMANCE SPEAKER SYSTEM

A partnership with Henry Kloss (of Cambridge Sound waves), an honored audio pioneer, has produced a speaker system that matches the CD quality of our Doppler audio. What you see is what you hear, exactly, and the audio will not alias.

SST™ COLOR DOPPLER

Unparalleled Color Doppler sensitivity, spatial resolution, and temporal resolution are clear proof of what Sequoia system technology can do. Within this architecture, multiple color beamformers and Acuson's proprietary color processing play a clear role in achieving this high performance.

The trade-offs in performance associated with beamformer-based systems no longer apply.

Color Doppler performance is characterized by simultaneous achievement of:

- High spatial resolution
- High Frame rate, equal to what is obtained in 2-D mode in beamformer- based systems
- High sensitivity, equal to that achieved by CDE Color Doppler Energy mode in beamformer- based systems

TRANSDUCER TECHNOLOGY

Sequoia's system breakthrough in design principles and architecture required advances in the transducer technology.

New controlled bandwidth acoustics, new cable and connector technology, and new industrial design, have resulted in transducers with increased sensitivity, higher operating frequencies, and a new standard of comfort and handling.

MP CONNECTOR TECHNOLOGY

A strategic partnership between Acuson and a major connector manufacturer has produced a breakthrough, patented, connector design.

The MP connector has no pins, has zero insertion force, provides 612 connections and overcomes the limitations of conventional connectors. The Sequoia system has enough connections to incorporate active electronics in the transducer, opening the door to new transducer performance improvements.

WORKSHEET: SYSTEM TECHNOLOGY

Lab	Objective	Notes	Sign Off
System Technology Features			